

REINSTATEMENT AND REVISION OF CLEISTOCALYX
BLUME (INCLUDING ACICALYPTUS A. GRAY),
A VALID GENUS OF THE MYRTACEAE

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With plate 215

THE GENUS *Cleistocalyx*, proposed by Blume, Mus. Bot. Lugd.-Bat. 1: 84. 1849, with two species, *C. nitidus* Blume and *C. nervosus* Blume, very soon (Miq. Fl. Ind. Bat. 1(1): 442. 1855) dropped into synonymy under *Eugenia* (Micheli) Linnaeus, and has since remained more or less in obscurity. The reasons for this are various. Generic lines are somewhat uncertainly drawn in the MYRTEAE, and *Cleistocalyx* is but one of several genera proposed by Blume which most modern authors have included in *Eugenia* Linn. *sensu latiore*. The latter, thus interpreted, is admittedly heterogeneous, including not only the American forms, section *Eueugenia*, but also *Jambosa* DC., *Syzygium* Gaertn. and other proposed segregates, which may or may not be separable by definite generic characters.

Cleistocalyx is known to most workers only by the original generic description and that of the type-species. In both the generic and the specific descriptions, although Blume's paper is illustrated by an excellent plate, the description of the outstanding character of the genus is partly misleading, "Calyx . . . limbo supero, primum clauso, sub anthesi in lobos 4 v. 5 irregulares longitudinaliter fisso, deciduo." The closed calyces are easily found in an inflorescence with buds, yet of these, none in our material open by splitting longitudinally into four or five irregular lobes, but rather by an irregular transverse dehiscence (really a rupturing of the tissue) between the calyptra and the rest of the calyx, often leaving a ragged margin which, in older flowers of more than one species, has led botanists to describe the calyx as lobed; cf. descriptions of *C. barringtonioides* (Ridl.), *C. nicobaricus* (King) and *C. operculatus* (Roxb.). This evidence would have been sufficient to place *Cleistocalyx* beyond consideration as the proper generic name for the calyptrate species of "*Eugenia*," except that Merrill, in his study of the Bornean types of *Eugenia* at the Rijks Herbarium in 1930, had written on one of the specimens which he had with him for comparison, "This is *Jambosa nitida* Korthals." *Jambosa nitida* Korth. is the basis of *Cleistocalyx*

nitidus Blume and hence the standard-species of the genus. Bentham, Jour. Linn. Soc. **10**: 165. 1869, intimated that Blume's description may have been drawn from something "accidental in a single detached calyx, or even conjectural; for, if well ascertained as an essential character, it would have been represented in the figure (of *C. nitidus* Blume)." Through the kindness of Professor H. J. Lam, Rijks Herbarium, we have since had the privilege of re-examining the type-collection of *Jambosa nitida* Korth. and of verifying the previous identification; the specimens show immature inflorescences and fruits, no flower even approaching anthesis, and, so far as we can see, no evidence of the longitudinal splitting which Blume described. It may be that Blume was influenced in his description of the calyx-lobes by his erroneous inclusion of *Eugenia nervosa* Lour. in *Cleistocalyx*, as Loureiro definitely described his species as having 4-lobed calyces. In all our specimens representing species of this group the circumscissile calyptra is entire after separation and, at least in early anthesis, remains attached at one side and this is the case with *Jambosa nitida* Korth. = *Cleistocalyx nitidus* Blume. The one constant character by which *Cleistocalyx* can always be distinguished from *Eugenia*, *sensu latiore*, and from the numerous Old World species of *Syzygium* and *Jambosa* is in its calyptrate calyces, the undivided, often more or less indurated upper parts of which fall as a lid. Blume's detailed illustration of *Cleistocalyx nitidus* (Korth.) Blume shows the undifferentiated calyptra with no indication whatever of calyx-lobes.

Miquel's treatment of the genus *Eugenia* contains four sections, the third of which is characterized thus, "Thyrsei terminales. Calycis tubus e basi leviter constrictâ semi-globosus, limbus in alabastris valde juvenilibus concreto-clausus, dein in lacinias 4-5 fissus." This is comparable to the extract from Blume's generic description above quoted; moreover, the section has only one species, *Eugenia nervosa* Lour., with *Cleistocalyx nervosus* Blume and *C. nitidus* Blume in synonymy. It is not clear to us why both Blume and Miquel should place a species with calyx described as "superus, 4-partitus, magnus: laciniis, obtusis, concavis" (Lour. Fl. Cochinch. **1**: 308. 1790), in a section or genus featuring the upper part of the calyx entirely closed; yet, since Loureiro's type is not extant we can only point out what appears to be a discrepancy. Further, Miquel certainly erred in reducing *Cleistocalyx nitidus* Blume to *Eugenia nervosa* Lour.

After reducing *Cleistocalyx* to *Eugenia*, Miquel, op. cit. 460, established the section *Symphysion* in the genus *Syzygium* on the following basis, "calyx adultus vertice membranaceo totus occlusus, tanquam operculum demum inferne lacerum cum operculo corollino (quod proprium

haud discernendum) ut videtur intime connatum circumscisse dejectum." The floral feature here delineated is the distinctive character of *Cleistocalyx* (Pl. 215). Miquel described two species, *Syzygium occlusum* Miq. and *S. javanicum* Miq. and added a note on *S. fruticosum* DC. Although our material of the first, *Horsfield 10*, is a mixture of branchlets bearing both flowers and leaves, and of separate inflorescences, the latter are not distinguishable from those of *C. operculatus* (Roxb.); we cannot say from the fragmentary type of *S. javanicum* Miq. whether it is characterized by an operculate calyx or not, but the description surely indicates this group. The observation on *S. fruticosum* DC., as we understand the species, should be excluded.

In 1854, A. Gray, Bot. U. S. Expl. Exped. 1: 551, established the genus *Acicalyptus* for a species from the Fiji Islands with a very distinctive subulate-operculate quadrangular calyx. He indicated that its probable relationship was with *Calyptranthes* or *Eucalyptus*, depending on whether the fruit, then unknown, was a berry or a capsule. Among Seemann's collections from Fiji he found a second species with a short-apiculate calyptra. Seemann himself discovered a third species with the fruit a berry and the calyptra "just as it is in the ordinary American *Calyptranthes*," and therefore reduced *Acicalyptus* A. Gray to *Calyptranthes* Swartz. Bentham, op. cit. 144, discussing *Acicalyptus* pointed out that the seed was unknown but that the habit and the arrangement of the petals of Seemann's species, *C. eugenioides*, were more like those of *Eugenia* than of *Calyptranthes*. Later, under *Cleistocalyx*, he noted that its bud was that of *Acicalyptus* and if the latter should "really prove to have a Eugenioid embryo, it might be united with *Cleistocalyx* in a genus closely allied to *Eugenia* but differing . . . by the operculate calyx." Baron von Mueller, Bot. Centralbl. 28: 149. 1886, also pointed out that "it would appear, that *Acicalyptus* ought to be reduced to *Cleistocalyx*, published five years earlier by Blume." In his Second Systematic Census of Australian Plants, pt. 1. 102. 1889, he lists *Acicalyptus* thus, "Calyptranthes partly, Cleistocalycis subgenus," showing that he was still convinced of their very close relationship.

We now have *Acicalyptus myrtoides* A. Gray in fruit, collected by Gillespie and described by him, Bishop Mus. Bull. 83: 21, f. 25. 1931. We find it necessary to emend his description from "endosperm . . ." to: cotyledons two, large and hemispherical enclosing the hypocotyl and epicotyl attached near the centre of each of the opposing faces of the cotyledons, hypocotyl exceeding epicotyl in length; and correspondingly, on his legend of f. 25, we prefer the following: *a*, enlarged embryo showing cotyledons separated from hypocotyl and epicotyl; *b*, *c*, plantlet

minus cotyledons much enlarged. Fruits of the other Fijian species which are represented by herbarium material are similar. All are ellipsoid or oblong with the angles of the calyx (usually appearing as a narrow ridge) more or less marked on the fruit. The structure of the embryo, so far as we can interpret it from dried and immature fruits, does not differ materially from the general type of that in *Cleistocalyx*: cotyledons with the two opposing and almost flat or concave (perhaps from shrinkage) faces attached to the minute hypocotyl and epicotyl. A variation in the type appears in *C. operculatus* (Roxb.) and *C. Fullageri* (F. v. Muell.); the embryo of these consists of two cotyledons with *interlocking* faces attached near the middle with a long hypocotyl between, extending from the point of attachment near the centre to the outer surface of the embryo (Pl. 215, f. 32, 43). Possibly we might be inclined to look upon these as two distinct types of embryo were it not for the fact that in *Syzygium* these two extremes blend to such an extent that it is impossible to distinguish the two except in the extremes as shown in this genus.

With only the original species, *A. myrtoides* A. Gray, at hand, the smooth and sharply angled calyx and the long rostrate calyptra appear very distinctive; but, with more material for comparison, these are manifestly the extreme form of the characters of the genus and, only when modified, applicable to species which must be considered congeneric; furthermore, the several species placed herein are separable from *Cleistocalyx* only by two minor characters, the angular calyx and to a less degree the angular and elongated fruit. These are good sectional characters but scarcely of generic worth; hence, we find ourselves unable to maintain the genus *Acicalyptus* A. Gray as distinct from *Cleistocalyx* Blume, the latter having nomenclatural precedence. However, since the Fijian species apparently represent a natural group distinguished by the angular calyx and the less angled and elongated fruit, we propose to treat *Cleistocalyx* as having two fairly distinct sections, ACICALYPTUS (A. Gray) and EUCLEISTOCALYX, the latter to include all species characterized by a terete calyx and globose to subglobose, rarely somewhat elongated, but not angled, fruit.

As we have already stated, the genus *Eugenia* in its broadest sense includes many diverse forms. From these we propose to segregate those species with calyptrate calyces, re-establishing the genus *Cleistocalyx* to take care of what we believe to be a distinct entity worthy of generic rank. *Acicalyptus* was originally known only from Fiji but later species were described from New Caledonia and Lord Howe Island. *Cleistocalyx* was described from a Bornean specimen. As we now interpret Blume's

genus, *Acicalyptus* falling as a synonym, the group is represented by twenty-one species extending from Chittagong, Burma, Indo-China, Hainan and southeastern China to Sumatra, Java, Borneo, the Philippines, New Guinea, northern Australia, Lord Howe Island, New Caledonia and Fiji. Thus, instead of *Acicalyptus* A. Gray being a "Polynesian" genus, *Cleistocalyx* Blume as we interpret it is primarily an Indo-Malaysian one that has extended to Fiji.

This study is based primarily on the material in the herbaria of the Arnold Arboretum, Gray Herbarium, New York Botanical Garden, and the Botanical Garden at Buitenzorg, with special loans of essential specimens from the Washington, Kew, Leiden, Utrecht, Brisbane, and Melbourne herbaria. To the administrative heads of the institutions involved we are under obligations for the courtesies extended in the loan of important material essential to this study. The actual preparation of the paper was rendered possible through a grant from the Milton Fund of Harvard University. The primary purpose of this grant was to make possible a general study of the Bornean species of *Eugenia*, but as the latter study developed it was found desirable to recognize certain generic segregates. In two cases we have found it expedient to segregate certain species from EUGENIA (including *Jambosa* and *Syzygium*) and to recognize these as of generic rank. Thus it became necessary to examine all recognized species in each group for the entire geographic range of the unit, as generic limits could not with safety be determined solely on the basis of the Bornean species alone. In this paper we consider the recognized species in the first of these two groups.

Cleistocalyx Blume, Bot. Mus. Lugd.-Bat. 1: 84. 1849.

Acicalyptus A. Gray, Bot. U. S. Expl. Exped. 1: 551. 1854.

Eugenia § 3, Miq. Fl. Ind. Bat. 1(1): 442. 1855.

Syzygium § *Symphysion* Miq. op. cit. 460, excl. *Syzygium fruticosum* DC.

Calyptranthes sensu Seemann, Fl. Vit. 81. 1865, non Swartz.

Acicalyptus (*Calyptranthes* partly, *Cleistocalyx* subgenus) F. v. Mueller, Second Syst. Census Austral. Pl. pt. 1: 102. 1889.

KEY TO SPECIES

- A. Calyx-tube definitely 4-angled; fruit \pm obscurely 4-angled, crowned by the very narrow but usually deep limb of the calyx (section *Acicalyptus*: Fiji).
 - B. Calyptra subulate-rostrate; fruit 4-ridged 1. *C. myrtoides*.
 - B. Calyptra not subulate-rostrate, \pm conical and obtusely apiculate.
 - C. Leaves elliptic to oblong or ovate, apex distinctly acuminate.
 - D. Flowers obviously pedicellate, pedicels up to 3 mm. long.
 - 2. *C. longiflorus*.

- D. Flowers sessile or, in part, very short-pedicellate, pedicels not longer than 1 mm.
- E. Submarginal veins 2, the inner 2–3 mm. within the margin; flower-buds 3.5–4 mm. long.3. *C. ellipticus*.
- E. Submarginal vein 1 mm. within the margin; flower-buds 4.5–6 mm. long (more attenuate toward base than in *C. ellipticus*)4. *C. Seemanni*.
- C. Leaves obovate, apex obtuse or rounded5. *C. eugenioides*.
- A. Calyx-tube terete and smooth, \pm wrinkled-sulcate on drying; fruit not angled, crowned by the broad and usually \pm shallow limb of the calyx (section *Eucleistocalyx*).
- F. Flowers long, calyx-tube (after calyptra has fallen) \pm 18 mm. long (Lord Howe Island)6. *C. Fullageri*
- F. Flowers shorter, calyx-tube (after calyptra has fallen) usually not exceeding 12 mm. long.
- G. Inflorescence axillary and terminal.
- H. Venation open, primary veins 5 mm. or more apart, secondary veins often obvious but not as prominent as the primary ones.
- I. Leaves rounded or slightly cordate at base, practically sessile7. *C. paradoxus*.
- I. Leaves obtuse or cuneate at base, or if somewhat rounded, distinctly petiolate.
- J. Branchlets 4-angled.
- K. Midrib somewhat sharply keeled on lower surface; leaves thinly coriaceous, copiously pellucid-punctate; submarginal vein \pm 1 mm. within the margin (New Guinea)8. *C. Bacuerlenii*.
- K. Midrib roundish, not keeled, on lower surface; leaves coriaceous, obscurely, if at all, pellucid-punctate; submarginal vein 2–4 mm. within the margin.
- L. Inflorescence short (3–5 cm. long) and compact; leaves densely glandular-punctulate beneath; primary veins impressed above, sharply prominent beneath (Borneo).
9. *C. perspicuinervius*.
- L. Inflorescence longer (up to 15 cm.) and open; leaves obscurely punctulate; primary veins not impressed above, prominent beneath.
- M. Leaves narrowly oblong; flowers with a long pseudostalk [5–7(–9) mm.] (Borneo).
10. *C. barringtonioides*.
- M. Leaves oblong-elliptic; flowers with a short pseudostalk [\pm 2.5 mm. long] (Borneo).
11. *C. nitidus*.
- J. Branchlets terete or sulcate.
- N. Leaves acuminate and often twisted at the apex.

- O. Submarginal veins not more than two, the inner usually not more than 4 mm. within the margin; calyptra mostly short-apiculate.
- P. Flowers with a long pseudostalk (5–7 mm.); leaves narrowly oblong (Borneo).
10. *C. barringtonioides*.
- P. Flowers with a short pseudostalk (2.5–3 mm.); leaves oblong- to narrowly ovate-elliptic.
- Q. Leaves oblong-elliptic; secondary venation manifest but not obvious.
- R. Leaves 10–20 cm. long; primary veins 15–22; secondary submarginal vein mostly obscure (Borneo).
11. *C. nitidus*.
- R. Leaves 8–12 cm. long; primary veins 8–13; secondary submarginal vein present (Philippines).
12. *C. arcuatinervius*.
- Q. Leaves broad- to ovate-elliptic; secondary venation obvious and tending to be prominent (Indo-China).
13. *C. retinervius*.
- O. Submarginal veins often more than two (three in larger leaves), the inner (usually prominent) 4–7(–12) mm. within the margin; calyptra conspicuously apiculate or short-rostrate (Queensland) . . . 14. *C. gustavioides*.
- N. Leaves obtuse or rounded with a short and abrupt acumen.
- S. Branchlets light-brown or grayish; petiole \pm 2 cm. long; leaves with large and scattering pellucid punctations; ultimate branchlets of inflorescence narrowly winged (Hainan).
15. *C. conspersipunctatus*.
- S. Branchlets whitish; petiole less than 1 cm. long; leaves minutely punctulate, not pellucid; ultimate branches of the inflorescence compressed or obscurely angled (Borneo).
16. *C. leucocladus*.
- H. Venation close, primary veins scarcely 2 mm. apart (*C. Brongniartii* not seen, but described as “creberrime penninervia”).
- T. Leaves subcaudate-acuminate (Philippines).
17. *C. paucipunctatus*.
- T. Leaves abruptly short-acuminate to obtuse.
- U. Leaves distinctly petiolate; calyptra not sulcate (Indo-China) 18. *C. nigrans*.
- U. Leaves sessile or very short-petiolate; calyptra sulcate (New Caledonia) 19. *C. Brongniartii*

G. Inflorescence lateral in the axils of old or fallen leaves below the new leafy shoots, rarely axillary and terminal.

V. Petiole short (5–8 mm. long) and thickish, the older often of the same color as the branchlets (whitish-gray); leaves chiefly obtusish; calyx-tube abruptly narrowed into short pseudostalk (Borneo)16. *C. leucocladus*.

V. Petiole longer (1–2 cm. long) and not thickened; branchlets gray to brownish; leaves obtusely short-acuminate; calyx-tube gradually tapering to the base.

W. Calyx-tube broadly attenuate at the base; primary veins of leaves obvious; inflorescence with many branches and numerous flowers (southern China, Indo-Malaysia and northern Australia)20. *C. operculatus*.

W. Calyx-tube scarcely attenuate at base; primary veins of leaves inconspicuous; inflorescence with few branches and sparsely flowered (Nicobar Islands).

21. *C. nicobaricus*.

1. **Cleistocalyx myrtoides** (A. Gray), comb. nov. Pl. 215, f. 6–8.

Acicalyptus myrtoides A. Gray, Bot. U. S. Expl. Exped. 1: 551. t. 67. 1854, Bonplandia 10: 35. 1862; Drake, Ill. Fl. Mar. Pacific. 168. 1890; Gillespie, Bishop Mus. Bull. 83: 20. f. 25. 1931.

Calyptranthes myrtoides Seemann, Fl. Vit. 81. 1865.

FIJI: *Herb. U. S. Expl. Exped. 1838–42* (type-collection of *A. myrtoides*); Viti Levu, Tholo North Province, Nandarivatu, *Gillespie 3971*, stream-bed down the escarpment north of Government Station.

This species is readily separable from the others, which we have seen, by the strongly angled calyx which does not wrinkle much on drying, and by the subulate-rostrate beak of the calyptra. In 1886, Baron von Mueller, Bot. Centralbl. 28: 149, stated, "Regretably the name *Acicalyptus*, derived from an exceptional characteristic of the original species discovered, does not apply to most of the other forms, which must be considered congeneric." That is still true for the specimens which we have examined.

2. **Cleistocalyx longiflorus** (A. C. Smith), comb. nov. Pl. 215, f. 1–2.

Acicalyptus longiflora A. C. Smith, Bishop Mus. Bull. 141: 109, f. 57. 1936.

FIJI: without definite locality, *Storck s. n.*, June, 1883 (type-collection of *A. longiflora*); Viti Levu, *Gillespie 2277*, August 15, 1927, slopes of Korombamba mountain, at 300 m. alt.; Viti Levu, *Gillespie 3962*, Nandarivatu, secondary wood, valley of the Singatoka.

Not very closely related to the other Fijian species. In its foliar characters *C. longiflorus* is most like *C. ellipticus* (A. C. Smith); in the angularity of the calyces it approaches *C. myrtoides* (A. Gray); but, in

size of flowers and characters of the calyptra, it is unquestionably nearest *C. Seemanni* (A. Gray).

3. **Cleistocalyx ellipticus** (A. C. Smith), comb. nov. Pl. 215, f. 9.
Acicalyptus elliptica A. C. Smith, Bishop Mus. Bull. **141**: 107, f. 57.
1936.

FIJI: southern portion of Seatovo Range, *A. C. Smith 1567*, April 20–May 2, 1934, ridge forest at 100–350 m. alt. (type of *A. elliptica*).

Perhaps most closely related to *Cleistocalyx Seemanni* (A. Gray) from which it is separable by the larger leaves and the flowers slightly smaller and less narrowed toward the base.

4. **Cleistocalyx Seemanni** (A. Gray), comb. nov. Pl. 215, f. 3–5.
Acicalyptus Seemanni A. Gray, Bonplandia **10**: 35. 1862; Drake, Ill. Fl. Mar. Pacific. 168. 1890; A. C. Smith, Bishop Mus. Bull. **141**: 107. 1936.

Calyptranthes Seemanni Seemann, Fl. Vit. 81. 1865.

Eugenia prora Burkill, Kew Bull. **1906**: 4. 1906.

FIJI: *Seemann 168* (type of *A. Seemanni*); Mount Mbuke Levu, *A. C. Smith 241*; Mount Ndikeya, *A. C. Smith 1876*; Viti Levu, *Gillespie 2866*, ridges southeast of Namosi village on the overland trail to Navau at 600 m. alt.; without definite locality, *Horne 774*.

The two collections *Gillespie 2866* and *Horne 774* have slightly glandular-punctate leaves.

- 4a. **Cleistocalyx Seemanni** var. **punctatus**, var. nov.

A typo differt foliis utrinque dense minuteque subpustulato-glandulosis, calycibus leviter pustulatis.

FIJI: without definite locality, *Graeffe s. n.* (type, Gray Herb.).

The glands of the leaves are so abundant that the secondary venation is more or less obscure, the flowers too are minutely pustulate and the operculum is scarcely apiculate.

5. **Cleistocalyx eugenioides**, nom. nov.

Calyptranthes eugenioides Seemann, Fl. Vit. 81. 1865, non Cambessed., in St. Hilaire, Fl. Bras. Merid. **2**: 370. 1829.

Acicalyptus eugenioides Drake, Ill. Fl. Mar. Pacific. 168. 1890; Niedenz. in Engler & Prantl, Nat. Pflanzenfam. **3**(7): 86. 1893.

FIJI: Viti Levu, Nadarivatu, *Gillespie 4335*, December 13, 1927, summit of Loma laga, at 1200 m. alt.

When Seemann described this species he noted the similarity in habit to that of *Eugenia confertiflora* A. Gray. Gray had already pointed out that Seemann's collection had longer leaves less pale beneath, larger flowers with longer and striate-angled calyx-tubes, but he did not describe

it, probably because he had inadequate material, for he stated, "the means of comparison are not complete." We have not yet found the material which Gray had for comparison, nor have we seen any representative of this species except the specimen above cited. It is easily separated from the other Fijian members of *Cleistocalyx* by its obovate leaves.

6. **Cleistocalyx Fullageri** (F. v. Muell.), comb. nov.

Pl. 215, f. 29–33.

Acicalyptus Fullageri F. v. Muell. Fragm. Phytogr. Austral. 8: 15. 1873, 9: 193. 1875; Moore, Census Pl. New S. Wales, 28. 1884, Handbk. Fl. New S. Wales, App. 1: 519. 1893; Hemsl. Ann. Bot. 10: 236. 1896; Maiden, Proc. Linn. Soc. New S. Wales, 23: 129. 1898; Oliver, Trans. New Zeal. Inst. 49: 144, f. 1a. 1917.

LORD HOWE ISLAND: authentic specimen, without data; *Moore, Fullagar & Lind* (type, Melbourne Nat. Herb., not seen).

The specimen generously donated to our collection by Mr. F. J. Rae, Director of the Melbourne Botanic Gardens, has greatly aided us in our interpretation of this species. Although Baron von Mueller gave a very detailed description of *A. Fullageri*, pointing out how it differs chiefly from its Fijian allies, we here add a short summary of the distinctive characters: Very long flowers (Pl. 215, f. 30), the mature calyx-tube \pm 18 mm. long, the longest known in the genus; ellipsoid or somewhat pyriform fruits; short-petiolate obovate, obtuse leaves, and branchlets \pm angled or sulcate. *C. Fullageri* (F. v. Muell.) appears to be more closely connected with § *Eucleistocalyx* than with § *Acicalyptus*, although it is very distinct within the genus.

The collector's name is given as Fullagar, but F. von Mueller in the binomial used the form *Fullageri* which we accept; other authors cited use the form *Fullagari*.

7. **Cleistocalyx paradoxus** (Merr.), comb. nov. Pl. 215, f. 37–38.

Eugenia paradoxa Merr. Jour. Str. Branch Roy. As. Soc. 77: 210. 1917, Enum. Born. Pl. 432. 1921.

BORNEO: Sarawak, without locality, *Native collector 365* (type of *E. paradoxa* Merr.); near Kuching, *Haviland 2327/1832*: Dutch Borneo, Soengei Sambas, *Hallier 1160*; Soengei Landak, *Teysmann s. n.*; Pontianak, *Teysmann s. n.*; Kapuas, *Teysmann 8224*; without locality, *Teysmann?*; near Poetat, *Mondi 54*.

The only species of the genus known to us with rounded or slightly cordate, practically sessile leaves.

8. **Cleistocalyx Baeuerlenii** (F. v. Muell.), comb. nov. Pl. 215, f. 21.

Eugenia Baeuerlenii F. v. Muell. Australas. Jour. Pharm. June, 1886, Bot. Centralbl. 28: 149. 1886; Diels, Bot. Jahrb. Engler 57: 379. 1922.

NEW GUINEA: Strickland River, *Baeuerlen s. n.* (type); Fly River (Branch), *Baeuerlen 538*, November, 1885.

Diels, l. c. (Die Myrtaceen von Papuasien), merely notes that the description of *Eugenia Baeuerlenii* F. v. Muell. was insufficient to determine its place within the genus (*Jambosa*).

Mr. F. J. Rae, Director of the Melbourne Botanic Gardens very kindly loaned for our study the two specimens cited above. In general aspect the species is very distinct; the venation of the leaves approaches subtransverse, the blade is somewhat reddish-brown, shining, and, although it is scarcely, if at all, punctate, against a strong light it is copiously pellucid-dotted. The calyx is cupulate with a pseudostalk and dries with distinct ridges.

9. **Cleistocalyx perspicuinervius** (Merr.), comb. nov.

Pl. 215, f. 10–11.

Eugenia perspicuinervia Merr. Univ. Calif. Pub. Bot. 15: 218. 1929.

BORNEO: British North Borneo, Tawao, *Elmer 20600, 21682* (type of *E. perspicuinervia* Merr.).

A species which suggests *C. nitidus* Blume in the large and prominently veined leaves, but which is easily distinguished by its short (up to 5 cm. long) and few-flowered axillary and terminal inflorescences.

10. **Cleistocalyx barringtonioides** (Ridl.), comb. nov.

Pl. 215, f. 25–28.

Eugenia barringtonioides Ridl. Jour. Bot. 68: 12. 1930.

BORNEO: British North Borneo, without definite locality, *Villamil 406*, on river banks; Tenom, *Tahir 787*; Lokan River, *Evangelista 906*; Sandakan, *Panching 817*; Pangie, Beaufort, *Bakar (B. N. B. Forestry Dept. 2472)*, river-bank; Melobang, *Balajadia (B. N. B. Forestry Dept. 2849)*, plain, sea level; Sarawak, Trusan, *Haviland 52/118*; Upper Baram, Sio Malit, *Moulton 6740* (type-collection of *E. barringtonioides* Ridl.): Dutch Borneo, Sedalir, *Amdjah 248*; Batoe Oeloe Seboekoe, *Amdjah 527*; Gunong Djempanja *Amdjah 734*; Western Koetai, near Batoe Bong, *Endert 2195*; near Boloet, *Endert 4042*.

A distinctive species of river-banks readily recognized at anthesis by the open panicles bearing flowers with long (5–7(–9) mm.) pseudostalks and long (± 2 cm.) stamens. The leaves are mostly lanceolate or narrowly oblong.

Eugenia barringtonioides Ridl. was based on *Moulton 6740* from

Upper Baram, indicated by Ridley as *Jambosa*. He describes the calyx as having "lobis obscuris brevibus, rotundatis." This statement applies to the persistent fragments of the calyptrate calyx, as an examination of the type shows that in the bud the calyx has a calyptra which breaks off and falls as a whole, leaving a torn irregular margin which was misinterpreted by Ridley as calyx-lobes.

11. **Cleistocalyx nitidus** Blume, Mus. Bot. Lugd.-Bat. **1**: 84, f. 56. 1849. Pl. 215, f. 19-20.

Jambosa nitida Korth. Nederl. Kruidk. Arch. **1**: 202. 1847, non Cambessed. et al.

Eugenia nervosa sensu Miq. Fl. Ind. Bat. **1**(1): 442. 1855, non Lour.

Eugenia cleistocalyx Merr. Philip. Jour. Sci. Bot. **13**: 98. 1918, Enum. Born. Pl. 427. 1921.

BORNEO: British North Borneo, Tawao, *Elmer* 20836, 21702; Kina-batangan, *Evangelista* 861; Lihak, *Agullana* (*B. N. B. Forestry Dept.* 1946), plain: Sarawak, Rejang, Kapit, *Haviland* 2921; Dutch Borneo, Kampong Lemoe, Taloe Gansioeng forest, Oeloe Doesoen, *Dachlan* 2407; Soengei Magne, *Jaheri* 664; Soengei Tepoetiz, *Jaheri* 901; Banjarmasin, Mount Bahay, *Korthals s. n.* (carbon imprint of leaf; type, Rijks Herb.); *Winkler* 3744.

This, the type-species of the genus *Cleistocalyx*, and *C. barringtonioides* (Ridl.) very closely resemble each other but apparently are distinct. *C. nitidus* Blume differs in having broader leaves and the flowers, with short (2-3 mm. long) pseudostalk and short anthers, closely clustered at the tips of the branches of the inflorescence. The collection from Lihak differs somewhat in its narrowly winged branchlets and its very shiny and pale brown leaves.

12. **Cleistocalyx arcuatinervius** (Merr.), comb. nov.

Pl. 215, f. 16-18.

Eugenia arcuatinervia Merr. Philip. Jour. Sci. **1**: Suppl. 104. 1906;

C. B. Rob. Philip. Jour. Sci. Bot. **4**: 380. 1909; *Elmer*, Leaflet. Philip.

Bot. **4**: 1418. 1912; Merr. Enum. Philip. Pl. **3**: 158. 1923.

PHILIPPINE ISLANDS: Luzon: Bataan Province, Lamao River, Mount Mariveles, *Whitford* 1227, *Meyer* (*For. Bur.* 2598); Cagayan Province, *Klemme* (*For. Bur.* 6669), *Barros* (*For. Bur.* 21760, 21777), *Fischer* (*For. Bur.* 21747); Laguna Province, *Mabesa* (*For. Bur.* 23792); Rizal Province, *Maneja* (*For. Bur.* 23963); Sorsogon Province, Irosin, *Elmer* 16220; Mindoro, *Ramos* (*Bur. Sci.* 39380); Leyte, *Wenzel* 726, 755, 886, 1524; Mindanao, Surigao Province, *Wenzel* 2661, 2787, 2960, *Sherfese*, *Cenebre & Ponce* (*For. Bur.* 21664).

There is a pronounced resemblance between this species and *C. nitidus*

Blume. Technically *C. arcuatinervius* (Merr.) may be distinguished by its foliar characters. The leaves are smaller and long-acuminate, the primary veins are fewer and a secondary submarginal nerve is always present.

13. **Cleistocalyx retinervius**, sp. nov. Pl. 215, f. 12–15.

Arbor parva; ramulis ultimis fuscis, teretibus vel ad nodos leviter compressis, 2–3 mm. diametro; foliis ellipticis vel oblongo-ovatis, 9–14 cm. longis, 5.5–7 cm. latis, basi late obtusis, fere rotundatis, apice late obtuse-que acuminatis et recurvis, epunctatis, olivaceis vel atro-brunneis, subtus pallidioribus vel rubro-brunnescentibus, costa supra impressa subtus leviter elevata, venis primariis perspicuis numerosis 4–8 mm. remotis patulis, plerumque ad marginem leviter curvatis, vena intramarginali (interdum duplici) 2–3 mm. a margine conjunctis, venulis laxe reticulatis perspicuis; petiolo circiter 1.5 cm. longo, nigrescente vel brunneo, transverse ruguloso; inflorescentiis terminalibus axillaribusque, ramis brevibus, floribus \pm confertis, sessilibus, alabastris \pm 7 mm. longis, apice ovoideo-globosis, basi stipitatis; calyce in alabastro clauso leviter apiculato, per anthesin calyptriformi-circumscisso, marginem subintegrum relinquente, petalis liberis?, staminibus numerosis, antheris ellipticis; fructibus subglobosis, circiter 1.5 cm. diametro, apice calycis limbo coronatis.

INDO-CHINA: Annam, Tourane and vicinity, *Clemens* 3777 (type), 3395, May–July, 1927, in thickets near the seashore. The holotype is in the herbarium of the Arnold Arboretum, with isotypes in the New York and Washington herbaria.

Although this species was collected in a region where *Eugenia nervosa* Lour. might be expected to occur, we have carefully compared the description with our material of which we have both flowers and fruit, and we particularly note the following discrepancies between *Eugenia nervosa* Lour. and *Cleistocalyx retinervius* Merr. & Perry both in the calyx and in the fruit. In the former, the calyx is lobed, the fruit “nervosa” (probably the equivalent of *ribbed*); in the latter, the calyx is calyptrate and the fruit is practically smooth.

14. **Cleistocalyx gustavioides** (F. M. Bail.), comb. nov.

Pl. 215, f. 50–53.

Eugenia gustavioides F. M. Bailey, Queensl. Agric. Jour. 5: 389. 1899; J. F. Bailey, Queensl. Agric. Jour. 5: 399, t. 140. 1899; F. M. Bailey, Queensl. Fl. 2: 658. 1900, Cat. Queensl. Pl. 208. 1913.

AUSTRALIA: Queensland, without data, *J. F. Bailey s. n.* (type); near Lake Barrine, Atherton Tablelands, *J. F. Bailey s. n.* (fruit only);

Atherton Tableland, Range Road, *Kajewski 1185*; Forest Reserve 310, Galgarra, *Dreghorn s. n.*; Daintree River, *Brass 2256, Kajewski 1398*.

Mr. C. T. White, government botanist at Brisbane, has obligingly loaned us the type and Dreghorn's collection, also the fruit; these are the only specimens of this species at Brisbane apart from the other collections above cited.

The leaf-venation of this species is rather unusual. The largest and most conspicuous intramarginal vein is from 4 to 7 (to 12) mm. within the margin; in the blade between may be found one (or sometimes two) similar vein(s), the outer(most) being the fainter(est) and 1 to 2 mm. within the margin. The fruit available is fully mature (Pl. 215, f. 50, 51). J. F. Bailey noted that he picked this up under a tree. Only a fragment of the hypocotyl remains, but unquestionably the fruit is similar in structure to that found in a large number of species of *Syzygium*.

15. **Cleistocalyx conspersipunctatus**, sp. nov. Pl. 215, f. 34–36.

Arbor 15–40 m. alta, glabra; ramulis novellis obscure tetragonis, demum teretibus vel compressis, brunneo-viridibus; foliis obovato-ellipticis, basi cuneatis, apice rotundatis, acumine brevi obtusoque, 5–13 cm. longis, 3–7 cm. latis, consperse pellucido-punctatis (glandulis magnis, interdum sine lente manifestis), costa supra impressa subtus prominula, venis primariis utrinque perspicuis, 4–8 mm. remotis, ad marginem anastomosantibus, venulis laxe reticulatis; petiolo 1.5–2 cm. longo, gracili, ruguloso; inflorescentiis terminalibus axillaribusque, 7–10 cm. longis, rachide quadrangulari, ramulis tetrapteris; alabastris sessilibus, 7 mm. longis 4.5 mm. diametro, apice globosis basi breviter stipitatis, consperse glanduloso-pustulatis; calyce clauso, apice breviter apiculato, parte superiore sub anthesi circumscisse decidua, antheris 0.6–0.8 mm. longis, ellipticis, glanduloso-mucronatis; fructibus subglobosis, immaturis 1.5–2 cm. diametro.

CHINA: Hainan, without locality, *Wang 33524, 33687, 34214*, in mixed woods, August and September, 1933; Po-ting, *How 73248, 73332* (type); Ah Ping, *Chun & Tso 44145*, October 24, 1932, in forested ravine, about 900 m. alt.; Yaichow, *Liang 62200*, July 19, 1933, in forests. The holotype is preserved in the Arnold Arboretum herbarium.

This species is readily distinguished from *C. operculatus* (Roxb.), the other known Chinese species of the genus, by the blunt leaves with short obtuse acumen and with scattered glands occasionally large enough to be seen with the naked eye, and by the terminal and axillary inflorescences. The flowers are larger and with a few glands similar to those on the

leaves; the cotyledons of the embryo are somewhat concave and the hypocotyl is short, closely resembling that of the Bornean *C. barringtonioides* (Ridl.).

16. **Cleistocalyx leucocladus**, sp. nov. Pl. 215, f. 39–40.

Eugenia subrufa sensu Ridl. Jour. Bot. 68: 15. 1930, non King.

Glabra; ramis ramulisque albido-cinereis, teretibus; foliis ellipticis, basi late cuneatis, apice obtusis vel brevissime obtuseque acuminatis, 6–10 cm. longis, 3–5.5 cm. latis, coriaceis, olivaceis, crebre punctulatis, costa supra impressa, subtus elevata, venis primariis gracilibus, patulis, haud perspicuis, utrinque 10–18 inter se 5–9 mm. distantibus, in venam intramarginalem \pm 2 mm. a margine distantem confluentibus, secundariis inconspicuis; petiolo crasso, 5–7 mm. longo; inflorescentiis terminalibus et in ramulis annotinis axillaribus, \pm 6 cm. longis, pedunculo communi ad 5 cm. longo, ramis \pm 1.5 cm. longis, floribus in apice ramulorum ultimorum ternis, sessilibus, alabastris 6 mm. longis, 3.5 mm. diametro; calycis parte superiore sub anthesin calyptratim decidua, staminibus numerosis, antheris minutis.

BORNEO: Sarawak, near Kuching, *Haviland & Hose 3382 A, E, L, M*, holotype at Gray Herbarium, isotypes at Kew, Leiden, and Buitenzorg.

In general habit this species suggests *C. conspersipunctatus* Merr. & Perry of China, but it is readily distinguished by the much shorter and thickish petioles, the broader leaf-base, the smaller flowers and the obtusely angled branches of the inflorescence.

17. **Cleistocalyx paucipunctatus**, nom. nov. Pl. 215, f. 22–23.

Eugenia paucipunctata Merr. Philip. Jour. Sci. Bot. 10: 215. 1915, non Koord. & Val.

PHILIPPINE ISLANDS: Luzon, Benguet Subprovince, *Merrill (Philip. Pl. 1709)*, distributed as *E. calcicola* Merr.

The habit of this species resembles *Eugenia calcicola* Merr., although technically it clearly belongs to the genus *Cleistocalyx*. The close venation of the leaves, the conspicuous acumen and the compact inflorescence suggest an alliance with the smaller flowered species of the *Acicalyptus* section, but the flowers are not at all angular. The species probably is most nearly related to *C. nigrans* (Gagnep.) but, in the latter, the venation is finer and not only more evenly distributed but also not elevated on the lower surface; the leaves are much more glandular-punctate.

18. **Cleistocalyx nigrans** (Gagnep.), comb. nov. Pl. 215, f. 24.

Eugenia nigrans Gagnep. Not. Syst. 3: 329. 1917, Fl. Gén. Indo-Chine, 2: 814. 1920.

COCHIN-CHINA: Cai-cong, Ongien, *Pierre* 1934 (type, Herb. Paris).

Doctor F. Gagnepain very generously sent us fragments of a number of his types of *Eugenia*, among others, *E. nigrans* Gagnep. In the original description of this species the calyx is characterized as perfectly truncate, neither lobed nor undulate. This is quite accurate for a full-blown flower, but in the bud of our fragments the apex of the calyx is entirely closed; the latter is the distinctive feature of *Cleistocalyx*.

C. paucipunctatus (Merr.), of the Philippine Islands, is somewhat similar in the size and the shape of the flower-buds as well as in the close venation of the leaves; the latter, however, really differ in outline and in type of venation. The leaves of *C. paucipunctatus* (Merr.) are subcaudate-acuminate with somewhat unevenly distributed veins; whereas, those of *C. nigrans* (Gagnep.) are acuminate-obtuse with more finely reticulate and more evenly arranged venation.

19. **Cleistocalyx Brongniartii**, nom. nov.

Acicalyptus nitida Brongn. & Gris, Ann. Sci. Nat. V. Bot. 3: 227. 1865, Bull. Soc. Bot. France, 12: 186. 1865; Däniker, Vierteljahrssch. Naturf. Gesellsch. Zürich, 78: Beibl. 19: 307. 1933.

NEW CALEDONIA: near Balade, *Vieillard* 534, 538 (not seen).

The characteristic features of the genus *Cleistocalyx* are well portrayed in the original description of the above species. It is not easy to determine, without material, which are the best specific characters, but possibly they are the very short-petiolate leaves, the congested inflorescences and the perceptibly narrowed (rather than hemispheric) and sulcate calyptras. Brongniart and Gris' specific name is invalid in *Cleistocalyx*.

20. **Cleistocalyx operculatus** (Roxb.), comb. nov. Pl. 215, f. 41-48.

Eugenia operculata Roxb. Hort. Bengal. 37. 1814, *nomen nudum*, Fl. Ind. ed. 2, 2: 486. 1832; Wight, Ic. 2(3): 4. t. 552. 1843; F.-Vill. Novis. App. Fl. Filip. 85. 1880; Koord. & Val. Meded. Lands Plant. 40: 148. 1900 (Bijdr. Boomsoort. Java, 6: 148); Koord. Exkursionsfl. Java, 2: 679. 1912; Koord.-Schumach. Syst. Verzeichn. Herb. Koord. 1(1²²²): 58. 1912; Koord. & Val. Atlas Baumart. Java, 3: f. 503. 1915.

Syzygium nervosum DC. Prodr. 3: 260. 1828, Mém. Myrt. 2: t. 16. 1842, excluding interpretation of genus p. 41.

Calyptranthes Makal Blanco, Fl. Filip. 419. 1837, non Raeusch.

Calyptranthes Zuzygium Blanco, op. cit. ed. 2, 293. 1845, ed. 3, 2: 179. 1878, non Sw.

Calyptranthes mangiferifolia Hance ex Walp. Annal. 2: 629. 1851-52.

Syzygium nodosum Miq. Fl. Ind. Bat. 1(1): 447. 1855.

Syzygium angkolanum Miq. op. cit. 448.

Eugenia Holtzei F. v. Muell. Australas. Jour. Pharm. June, 1886, Bot. Centralbl. 28: 148. 1886.

Syzygium operculatum Niedenz. in Engler & Prantl, Nat. Pflanzenfam. 3(7): 85. 1893; Gamble, Fl. Madras, 1: 481. 1919.

Eugenia Holtzeana F. v. Muell., Maiden, Dept. Agric. Sydney, N. S. Wales, Misc. Publ. 282: 22. 1899 (Native Food Plants).

Eugenia clausa C. B. Rob. Philip. Jour. Sci. Bot. 4: 380. 1909; Merr. Sp. Blanco. 288. 1918, Enum. Philip. Pl. 3: 162. 1923.

Eugenia divaricato-cymosa Hayata, Icon. Pl. Formos. 3: 118. 1913.

Eugenia Holteana F. v. Muell., Ewart & Davies, Fl. North. Terr. Austral. 202. 1917.

INDIA: type described from tree, cultivated in Royal Bot. Gard., Calcutta, said to be native of Amboina; copy of original Roxburgh plate ex herb. Calcutta (also reproduced in Wight Ic. t. 552); sketch of leaf, and flower of authentic material of *E. operculata* Roxb. (DeCandolle's Prodrumus Herb.); Chittagong Hill Tracts, *King's collector 315*; North Arakan, *Hildebrand 13*; CHINA, Kwangtung, *S. Y. U. 50364, 89693, Wang 9421 (S. Y. U. 67781)*; Canton and vicinity, *Levine 1288, 2126, Tsiang 11047*; Honam Island, *Levine 1050*; Lofoushan, *Chun 8297, 40792*; Naam Hoi District, *Levine 3024*; White Cloud Mountain, *Levine 3129*; Weishang, Sunyi District, *Tsiang 2721*, side of stream; Ting Wu Shan, Kao-Yao District, *Tsiang 775, 1496, Liang 60737, Lau 20275*; Ying-Tak, Wentongshan, *Tso 22242*; Shi-wan-da-shan, *Tso 23371*; Hongkong, *Bodinier 613, Wright s. n.*; North Point, *Ford s. n.*, July 29, 1895; Tai-O, New Territory, *Wang 3189*; Ma Au Shan, Shatin, *Tsiang 215*; Upper Aberdeen Road, *Gibbs (Hb. Hongkong 10261)*; Kwangsi, Lungchau, *Morse 625*; Hainan, without locality, *Wang 32834, 34169*; Lin Fa Shan, Lam Ko District, *Tsang 166 (L. U. 15665), 343 (L. U. 17092)*; Hung Mo Shan, *Tsang & Fung 458 (L. U. 17992)*; Dung Ka, *Chun & Tso 43430*, along stream at about 500 m. alt.; Yaichow, *How 70840, 71120, Liang 61996*; Yeung Ling Shan, Ngai District, *Lau 78*; Pak Shik Ling and vicinity, Ching Mai District, *Lei 697, 918*; Tai-too, Seven Finger Mountain, *Liang 61722*; Liamui (Leng Mun), *Gressitt 1165*; INDO-CHINA, Annam, Nghe-An, (*no collector given*) 4, June 21, 1930; Cochin-China, without locality, *Pierre s. n.*; SUMATRA, Sigamata, near Rantau Parapat, Bila, *Rahmat Si Toroes 3196*; Upper Angkola, *Junghuhn* (Rijks Herb., type of *Syzygium angkolanum*); JAVA, Batavia, Tjitjadas, *v. Steenis 5407*; Preanger, Tjibodas, *v. Woerden 163, 178*; Pengalengan Forest, *Junghuhn* (Rijks Herb., type of *S. nodosum*); BORNEO: British North Borneo, Banguay Island, *Castro & Melegrito 1490*; Mount Kinabalu, Tenompok, *Clemens 28336*; Beaufort, *Bakar (B. N. B. Forestry Dept. 3302)*; Dallas, *Clemens 27542, 27562*; Penibukan, *Clemens 30478*; Kiau, *Clemens 10101*; Sarawak, Mount Matang, *Clemens 20959*; Sibul, Rejang River, *Haviland 2845*; Mount Lingga,

Beccari 3943; Dutch Borneo, Pladjoe, *Amdjah 27*; Ben. Dajak, S. Betilap, *van Tuil 10* (*Boschproefstation bb: 11607*); Hayoep, *Winkler 2431*; Soengei Landak, *Teysmann 11248, 11250*; Goenoeng Kenepai, *Hallier 1684*: PHILIPPINE ISLANDS, Luzon, Ilocos, *Paraiso (For. Bur. 25453)*; Rizal Province, *Ramos (For. Bur. 13606)*, Antipolo, *Ahern's collector (For. Bur. 470)*, *Merr. Sp. Blancoan. 978, Ramos 314, Ramos & Edano (Bur. Sci. 29527)*; Bosoboso, *Merrill 2806*; Palawan, *Danao (For. Bur. 21596)*: AUSTRALIA, Port Darwin, *Holtze*.

Of all the known species of the genus *Cleistocalyx*, this is the commonest, the most widely distributed and perhaps the most misinterpreted. Its habit is generally assumed to be distinctive and certainly the copy of Roxburgh's original plate received through the courtesy of Dr. C. C. Calder, Superintendent of the Royal Botanic Garden, Calcutta, would confirm this idea. In the floral details in Roxburgh's original drawing the first figure (Wight, *Icones t. 552, f. 2*) shows a calyx with the characteristic calyptra with the corolla inside, explained by Wight as "a flower, petals separating," and the second figure (Wight, *Icones t. 552, f. 3*) a flower with the petals forcibly opened; this is manifestly schematic. However, there is in India at least one species of like habit with flower-buds similar in outline and such minute calyx-lobes that more than half our collections of these two species are identified as *Eugenia operculata* Roxb. This fact led us to question which was true *E. operculata* Roxb. A bud and a sketch of a half-open flower and a leaf from an authentic *Roxburgh* specimen in the Prodrum Herbarium very kindly supplied us by Professor B. P. G. Hochreutiner, Director of the Botanic Garden, Geneva, confirm the identification of botanists who have accepted Roxburgh's species as having flowers with calyptrate calyces. At the same time it should here be noted that in a number of floras (Benth. *Fl. Hongk. 119. 1861*; Brandis, *For. Fl. 234. 1874*; Kurz, *For. Fl. Brit. Burma, 1: 482. 1877*; Duthie in Hook. f. *Fl. Brit. Ind. 2: 498. 1879*; Trimen, *Handbk. Fl. Ceylon, 2: 179. 1894*; King, *Jour. As. Soc. Bengal, 70(2): 129. 1901* (*Mater. Fl. Malay. Pen. 3: 559*); Gagnep. in Lecomte, *Fl. Gén. Indo-Chine, 2: 817. 1920*; Ridl. *Fl. Malay Pen. 1: 754. 1922*) the calyx is described by such phrases as, "truncate," "with short obtuse lobes or nearly truncate," "not distinctly toothed," or "with short obtuse marginate teeth." Even Roxburgh's original description, "Calyx entire; corol operculate," which was followed by de Candolle in the Prodrum, is not too clear. De Candolle, *Mém. Myrt. 41. 1842*, points out very carefully that the difference between *Calyptranthes* and *Syzygium* is that the former has the operculum formed by the calyx lined by the petals, whereas the latter has the operculum formed by the petals cohering at

the top and the calyx is very short, sometimes truncate, sometimes 5-dentate visible below the operculum of the corolla; yet, op. cit., t. 16 (*Syzygium nervosum* DC.), which is one of four plates de Candolle used to illustrate the genus *Syzygium*, is practically perfect as to the detail of *Cleistocalyx operculatus* (Roxb.) except that in the younger buds the line of dehiscence between the calyptra and the calyx-tube is *not definitely marked* unless it be assumed from the color. This is an interesting feature of the bud. In dried material, the upper part of the calyx forming the calyptra becomes lighter than the lower part, in fact, much the same color as the corolla in the buds of other species. This may be the explanation of the misinterpretation of the calyx which has been so generally accepted.

Hance ex Walp. *Annal.* 2: 629. 1851-52, in his description of *Calyptranthes mangiferifolia* very clearly points out the calyptrate character of the calyx. Hance's description was based on a specimen from Macao, he believing that he had a true *Calyptranthes* introduced by the Portuguese from South America. Koorders & Valetton, *Meded. Lands Plant.* 40: 351. 1901 (*Bijdr. Boomsoort. Java* 6: 351) give an excellent description, "Calyx in alabastro clausus et saepe apiculatus per anthesin calyptriformi-circumscissus, marginem subintegrum vel pseudo-crenulatum relinquens."

As is to be expected of any wide-ranging species, *Cleistocalyx operculatus* (Roxb.) shows some variation in size of both leaves and flowers, and, since we have not found any constant characters in the material at hand for separating specimens from different regions, we are inclined to believe that a single species is represented.

The type of *Syzygium angkolanum* Miq. is one of the rare instances, in this species ordinarily characterized by lateral inflorescences, where the panicles appear to be axillary and terminal but apparently on leafy shoots of last season, and hence, lateral.

We are unable to maintain *Eugenia Holtzei* F. v. Muell. as a separate species. We strongly suspected this from the description and after examining the fragments of the type generously supplied by Mr. F. J. Rae, Director of the Melbourne Botanic Gardens, we are convinced that here is another collection of the wide-ranging *C. operculatus* (Roxb.).

A Ceylon specimen, *Thwaites*, *C. P.* 2801, distributed as *Syzygium firmum* Thwaites, *Enum. Pl. Zeyl.* 116. 1859, with a note, "cf. *Enum.* pp. 116, 417," in our herbarium seems to be without question *C. operculatus* (Roxb.). It surely does not belong to either of the above species referred to in the Enumeration (*C. P.* 2801 is cited under *S. polyanthum*, p. 116, i. e. *Eugenia polyantha* Wight), as we understand them.

21. **Cleistocalyx nicobaricus** (King), comb. nov. Pl. 215, f. 49.

Eugenia nicobarica King, Jour. As. Soc. Bengal, 70(2): 130. 1901 (Mater. Fl. Malay. Pen. 3: 560).

Eugenia occlusa sensu Duthie in Hook. f. Fl. Brit. Ind. 1: 498. 1879; Koord. & Val. Meded. Lands Plant. 40: 152. 1900 (Bijdr. Boomsoort. Java, 6: 152); Koord. Exkursionsfl. Java, 2: 679. 1912; Koord. & Val. Atlas Baumart. Java, 3: f. 504. 1915, non *E. occlusa* Kurz.

NICOBAR ISLANDS: Kurz (Herb. Calcutta; fragm.).

That Kurz apparently erred in naming his collection from the Nicobar Islands *Eugenia occlusa* (*Syzygium occlusum* Miq.), seems to be the opinion of botanists who have had access to his collection and to authentic material representing Miquel's species. Such erroneous identification, however, does not alter the fact that, since he based the combination *Eugenia occlusa* on Miquel's earlier name, nomenclaturally it can belong only to the species represented by Miquel's material. Koorders & Veleton likewise erred in applying the name to the species represented by Kurz's collection and in giving a new name to Miquel's species. King noted that Kurz's specimen differed so much from Miquel's description and an authentic specimen of Miquel's species (coll. *Horsfield*) that he gave it a new name.

The Superintendent of the Royal Botanic Gardens, Calcutta, very generously gave permission for Mr. Narayanaswami to send us a fragment of Kurz's collection. The leaf is epunctate and not pellucid-dotted, about 6 cm. long, on either side of the midrib are 7-8 inconspicuous primary veins somewhat arcuately anastomosing to form a submarginal vein about 1 mm. within the margin. The calyx does not appear so tapering toward the base as in *C. operculatus* (Roxb.). There is no evidence that *C. nicobaricus* occurs in Java.

UNIDENTIFIED AND EXCLUDED SPECIES

SYZYGIUM COSTATUM Miq. Fl. Ind. Bat. 1(1): 451. 1855.

This species is to be excluded from the synonymy of *C. operculatus* (Roxb.). The *Junghuhn* collection, Kupa Manok, Java, very kindly loaned for study by Professor Lam, Rijks Herbarium, is a foliar specimen which, as far as we can tell, is a reasonable match as to leaves and twigs for another collection labeled *S. costatum* by Miquel. The second specimen shows only a young infructescence, at times a difficult stage to interpret in the genus *Cleistocalyx*. However, within the limb of the calyx of one young fruit and apparently a part of the same flower is an evidently operculate corolla. This is a character of *Syzygium*, but in *Cleistocalyx* the corolla does not appear intact after the flower opens

unless associated with the calyptra of the calyx which often adheres to the calyx-tube even after the corolla has fallen.

SYZYGIUM FRUTICOSUM DC. Prodr. **3**: 260. 1828, Mém. Myrt. *t.* 19. 1842.

In a note following *Syzygium javanicum* Miquel, Fl. Ind. Bat. **1**(1): 462. 1855, it is suggested that *Syzygium fruticosum* DC. belongs to the section *Symphysion*, op. cit. 460, which, according to our interpretation, is a part of *Cleistocalyx*. Our herbarium material of *S. fruticosum* DC. has a definitely open lobed calyx and hence could not possibly belong in the genus under consideration.

SYZYGIUM JAVANICUM Miq. Fl. Ind. Bat. **1**(1): 461. 1855.

Doctor A. Pulle generously loaned us the type and another specimen labeled *S. javanicum* by Miquel. The latter, we are sure, does not belong to *Cleistocalyx*. The type is very fragmentary, one leaf and a detached inflorescence. The leaf is not a match for any of the species of this group. The flowers except for one shriveled and one maturing bud have all passed anthesis; unfortunately, the one bud which might reveal the distinctive character of the genus is pressed in such a way that it is impossible for us to say without removing it whether or not it is calyptrate. This, we have hesitated to do, hoping that, at some later date, it will be possible to examine a more complete specimen of the type-collection, *Horsfield*, near Soerakarta, Java.

EUGENIA NERVOSA Lour. Fl. Cochinch. **1**: 308. 1790; DC. Prodr. **3**: 284. 1828; Miq. Fl. Ind. Bat. **1**(1): 442. 1855 excl. syn.; Merr. Trans. Am. Philos. Soc. **24**(2): 285. 1935.

Myrtus Loureiri Spreng. Syst. Veg. **2**: 488. 1825.

Cleistocalyx nervosus Blume, Mus. Bot. Lugd.-Bat. **1**: 85. 1849.

If we interpret Loureiro's *Eugenia nervosa*, the basis of *Cleistocalyx nervosus* Blume, by the original description of the calyx, "Cal. superus, 4-partitus, magnus: laciniis, obtusis, concavis," there is no indication that the species belongs either to *Cleistocalyx* as defined by Blume or to the section of *Eugenia* in which it is placed by Miquel. Loureiro's type is not extant.

SYZYGIUM OCCLUSUM Miq. Fl. Ind. Bat. **1**(1): 460. 1855.

Eugenia occlusa Kurz, Jour. As. Soc. Bengal, **45**(2): 130. 1876, quoad syn.; Duthie in Hook. f. Fl. Brit. Ind. **2**: 498. 1879, quoad syn., excl. desc.

Eugenia symphysipetala Koord. & Val. Meded. Lands Plant. **40**: 153 (in nota), 161 (descr.). 1900 (Bijdr. Boomsoort. Java, **6**: 153, 161).

Miquel's species was based on *Horsfield 10* from Java. Koorders and



CLEISTOCALYX